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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
BARTON, JEFFREY THOMAS	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
11/04/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/799,257	NELLES ET AL.	
	Examiner	**Art Unit**	
	Jeffrey T. Barton	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 July 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3,25-38 and 42-48* is/are pending in the application.

4a) Of the above claim(s) *42-47* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3, 25-38, and 48* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendment filed on 25 July 2008 does not place the application in condition for allowance.

Election/Restrictions

2. Claims 42-47 stand withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 2 November 2007.

Status of Rejections Pending Since the Office Action of 25 January 2008

3. The rejections of claims 27, 28, 30, 31, 37, and 38 as unpatentable over Goossens et al in view of Nakamura are maintained.

4. All other previous rejections are withdrawn due to Applicant's amendment.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 3, 25-38, and 48 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 3 recites "a HTM layer" and "a dye layer" in line 14, but it is unclear whether these are required to be the HTM and dye recited earlier in the claim, or if they are additional layers. Claims 25-38 and 48 depend from claim 3, and are rejected for the same reasons.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 3, 27-31, 33, 34, 37, and 38 rejected under 35 U.S.C. 103(a) as being unpatentable over Goossens et al (Chem. Vap. Deposition. 4(3)109-114(1998)) in view of Nakamura (US 6,291,763)

Goossens et al disclose a method for producing a hybrid organic solar cell having the structure "Substrate+EM/SOL/dye/HTM/EM" as claimed, comprising vapor deposition of the SOL layer. (Experimental section, p. 114) CVD is used to deposit a TiO_2 SOL layer on fluorine-doped tin oxide disposed on a substrate (1^{st} full sentence below Table 1), which is used to make a dye-sensitized cell with the claimed structure. (Page 114, 2^{nd} column)

Goossens et al do not explicitly teach vapor deposition of a dye or HTM layer, any specific substrate material (Claim 27), a flexible substrate (Claim 28), using indium tin oxide as a TCO (Claim 30), any of the claimed HTMs (Claim 31), using plural dyes in a cell (Claim 37), or using a doped HTM. (Claim 38)

Regarding claims 3 and 31, Nakamura discloses numerous hole transport materials, including triphenylamine derivatives and polythiophenes (Column 27, line 37 - Column 28, line 30; particularly column 27, line 60 and Column 28, lines 19-20), and teaches that these can be vapor-deposited. (Column 28, lines 31-35; vacuum evaporation)

Regarding claims 27 and 28, Nakamura discloses disposing dye-sensitized cells on numerous types of substrates, including flexible polymers. (Column 5, line 52 - Column 6, line 21; particularly Column 6, lines 8-11)

Regarding claim 30, Nakamura discloses a variety of TCO materials, including ITO. (Column 5, lines 52-65)

Regarding claim 31, Nakamura discloses numerous hole transport materials, including triphenylamine derivatives and polythiophenes. (Column 27, line 37 - Column 28, line 30; particularly column 27, line 60 and Column 28, lines 19-20)

Regarding claim 37, Nakamura discloses using more than one dye in a cell. (Column 8, lines 10-13)

Regarding claim 38, Nakamura discloses a doped HTM. (Column 28, lines 23-30)

Regarding claims 3, 31, and 38, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Goossens et al by replacing the redox-couple electrolyte with a solid doped hole-transporting material, as taught by Nakamura, because it would reduce concerns with leaks and solvent evaporation in self-contained cells. All of the materials listed by Nakamura are known to be suitable for hole transport in this class of cells, and the selection of any would have been obvious to a skilled artisan. It would further have been obvious to deposit such a hole transport material by vacuum evaporation, because Nakamura teaches that vacuum evaporation is a suitable way of providing the organic

HTM layer. A skilled artisan would have turned to such conventional ways of providing the layers taught in the prior art.

Regarding claims 27 and 28, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Goossens et al by specifically using a flexible polymeric substrate, as taught by Nakamura, because Nakamura suggests that these are "competitive" (Column 6, lines 9-11), and a skilled artisan would have recognized the desirability, convenience, and marketability of flexible solar cells as being highly desirable.

Regarding claim 30, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Goossens et al by using indium tin oxide as the transparent conductor, as taught by Nakamura, because indium tin oxide is recognized in the art as essentially equivalent to fluorine-doped tin oxide in its function as a transparent conductor, as evidenced by Nakamura listing them together, describing both as being suitable. (Column 5, lines 59-63) The choice of either would have been obvious to one having ordinary skill in the art.

Regarding claim 37, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Goossens et al by using more than one dye in a cell, as taught by Nakamura, because Nakamura teaches that this broadens the region of wavelength conversion, which increases cell efficiency. (Column 8, lines 10-13)

11. Claims 3, 30-32, 36, and 38 rejected under 35 U.S.C. 103(a) as being unpatentable over Goossens et al in view of Saurer et al (US 5,482,570) and Tang. (US 4,164,431)

Goossens et al disclose a method for producing a hybrid organic solar cell having the structure "Substrate+EM/SOL/dye/HTM/EM" as claimed, comprising vapor deposition of the SOL layer. (Experimental section, p. 114) CVD is used to deposit a TiO_2 SOL layer on fluorine-doped tin oxide disposed on a substrate (1st full sentence below Table 1), which is used to make a dye-sensitized cell with the claimed structure. (Page 114, 2nd column)

Goossens et al do not explicitly teach vapor deposition of a dye or HTM layer, using indium tin oxide as a TCO (Claim 30), any of the claimed HTMs (Claims 31 and 32) or using a doped HTM. (Claim 38)

Saurer et al teach a method of making a hybrid solar cell including using an indium tin oxide electrode material (Column 3, lines 30-35; Column 4, lines 42-48; Figure 5), and using doped phthalocyanines, such as copper phthalocyanine as a hole transport material. (Column 6, lines 36-57; with an n-type titanium dioxide electrode, such material lying between the electrodes is inherently a hole-transporting material in a functional cell, and should obviously be p-type) The titanium dioxide electrode of Saurer et al is disclosed as being as thin as 100 nm. (Column 4, lines 54-56) Saurer et al are silent concerning how a copper phthalocyanine layer is made.

Tang teaches that copper phthalocyanine layers can be deposited by vapor sublimation. (Column 13, lines 58-61)

Regarding claims 3, 31, 32, and 38, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Goossens et al by replacing the redox-couple electrolyte with a solid hole transport material, such as doped CuPc, as taught by Saurer et al, because it would reduce concerns with leaks and solvent evaporation in self-contained cells and because Saurer et al teach these materials' suitability in carrying out this function in hybrid cells. It would further have been obvious to deposit such a copper phthalocyanine layer by vapor sublimation, as taught by Tang et al, because Tang teaches that this is an effective way of preparing a copper phthalocyanine layer. Particularly since Saurer et al are silent as to how the copper phthalocyanine layer is deposited, a skilled artisan would have turned to the related art, such as Tang, to select an appropriate way of preparing the copper phthalocyanine layer.

Regarding claim 30, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Goossens et al by using indium tin oxide as the transparent conductor, as taught by Saurer et al, because indium tin oxide is recognized in the art as essentially equivalent to fluorine-doped tin oxide in its function as a transparent conductor, as evidenced by Saurer et al listing them together, describing both as being suitable. (Column 3, lines 30-35; Column 4, lines 42-48) The choice of either would have been obvious to one having ordinary skill in the art.

Regarding claim 36, the Examiner's position is that the thickness of the semiconducting oxide layer is a parameter variable by a skilled artisan, depending on

the desired degree of transparency, for instance, where two TCO materials are used as electrodes. The principle by which the cells function is not altered by this thickness, and the Federal Circuit has held that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), *cert. denied*, 469 U.S. 830, 225 USPQ 232 (1984). Since the dye penetrates through much of the depth of the semiconducting oxide in cells of this type, a dye layer with the claimed thickness would obviously be present in a cell with the claimed oxide layer thickness.

12. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Goossens et al and Nakamura as applied to claims 3, 27-31, 33, 34, 37, and 38 above, and further in view of Yu et al.

Goossens et al and Nakamura are relied upon for the reasons given above. In addition, Nakamura teaches polyphenylenevinylenes among the solid organic hole transfer materials useful in dye-sensitized cells. (Column 28, lines 17-18)

Neither Goossens et al nor Nakamura explicitly teaches providing a layer of lithium fluoride near an electrode material, or such a layer having a thickness of 0.1 to 50 Å.

Yu et al teach that a 1-30 nm film of LiF between a polyphenylenevinylene semiconductor layer and an aluminum counter electrode improves the short circuit current and off-state voltage of a photovoltaic device. (Column 19, lines 55-58)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the method of Goossens et al by using a 1-30 nm film of LiF between the HTM and Al counter electrode, as taught by Yu et al, because Yu et al teach that this improves the short circuit current and off-state voltage of a photovoltaic device. (Column 19, lines 55-58)

13. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Goossens and Nakamura as applied to claims 3, 27-31, 33, 34, 37, and 38 above, and further in view of Yamamoto et al.

Goossens et al and Nakamura are relied upon for the reasons given above.

Neither Goossens et al nor Nakamura explicitly teaches increasing the surfaces as claimed.

Yamamoto et al teach that TCOs used as front electrodes in solar cells conventionally are textured, in order to increase light scattering, and thus the path length of the light, leading to increased absorption and cell efficiency. (Column 1, line 45 - Column 2, line 15) Such texture will inherently increase the interface surface area of the materials deposited on the TCO.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the method of Goossens et al by using a textured

indium tin oxide TCO, as taught by Yamamoto et al, because Yamamoto et al teach that the use of a textured TCO increases cell efficiency by increasing the path length of light through the cell. A skilled artisan would have recognized that such an advantage is desirable in any class of solar cell.

14. Claims 35 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goossens et al and Nakamura as applied to claims 3, 27-31, 33, 34, 37, and 38 above, and further in view of Sakurai et al. (US 6,310,282)

Goossens et al and Nakamura are relied upon for the reasons given above.

Neither Goossens et al nor Nakamura explicitly teaches a dye that is a di- or monosubstituted perylene as claimed.

Sakurai et al teach dye sensitized photovoltaic cells in which a perylene diimide is used as the sensitizing dye. (Column 14, line 66 - Column 15, line 6; Column 31, line 56-62; Column 33, lines 31-38)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Goossens et al by replacing the ruthenium dye with a perylene diimide dye, as taught by Sakurai et al, because Sakurai et al teaches the suitability of perylene diimide dyes as dyes for use in dye sensitized photovoltaic cells. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Response to Arguments

15. Applicant's arguments filed 25 July 2008 have been fully considered but they are not persuasive.

Applicant argues that the electrolyte of Goossens et al is not a hole transport material. While the Examiner respectfully disagrees with Applicant's position, the matter is moot, since the new grounds of rejection necessitated by Applicant's amendment all require solid hole transport materials that correspond to Applicant's narrower reading.

Applicant argues that Nakamura does not compensate for the purported deficiency of Goossens et al. The Examiner disagrees, noting that Nakamura very clearly teaches vapor deposition of hole transport materials, as claimed.

Applicant's remaining arguments are moot in view of the new grounds of rejection.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Jeffrey T. Barton whose telephone number is (571)272-1307. The examiner can normally be reached on M-F 9:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nam X Nguyen/
Supervisory Patent Examiner, Art Unit 1753

JTB
28 October 2008